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Willshere

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(54) **FRAME ASSEMBLY FOR SUPPORTING PRINTING SCREENS, A FRAME SUPPORT MECHANISM FOR SUPPORTING THE SAME, AND A METHOD OF MOUNTING PRINTING SCREENS IN A SCREEN PRINTING MACHINE**

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B41F 15/44 (2006.01)

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CPC ***B41F 15/36*** (2013.01); ***B41F 15/44*** (2013.01)

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USPC 101/128.1, 128, 127.1, 127, 126
See application file for complete search history.

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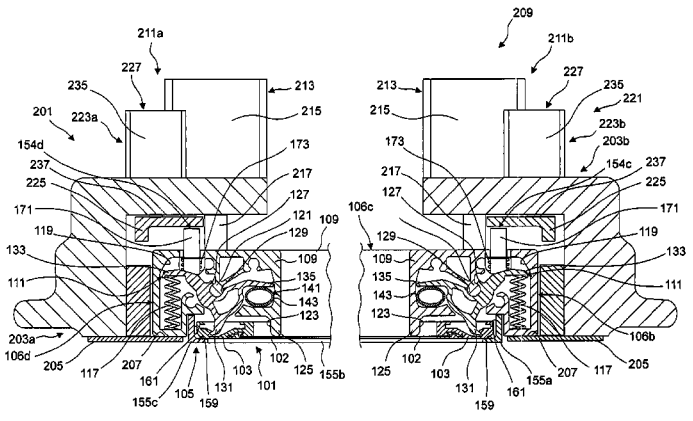
(57) **ABSTRACT**

A frame assembly for supporting a printing screen, the frame assembly comprising: a frame unit to which a printing screen is in use supported; and a screen loading mechanism for loading a printing screen into and unloading a printing screen from the frame unit, wherein the screen loading mechanism comprises a screen loading member which is movably coupled to the frame unit between a screen-receiving position in which a printing screen can be loaded into or removed from the screen loading member and a loaded position in which the printing screen is loaded into the frame unit, and at least one actuator element which is coupled to the screen loading member and actuatable to move the screen loading member between the screen-receiving and loaded positions.

19 Claims, 6 Drawing Sheets



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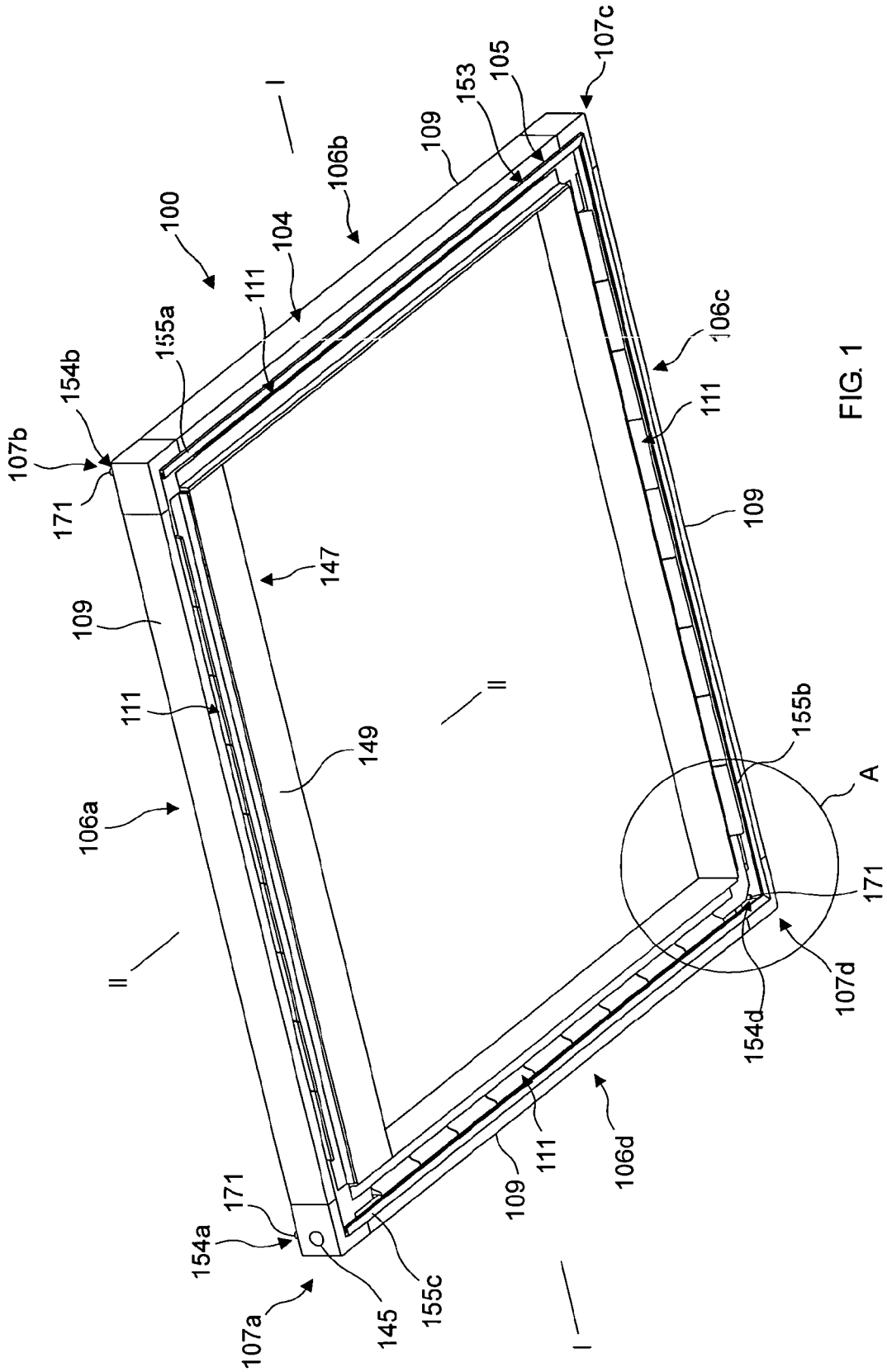
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II
100
104
105
106a
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106c
106d
107a
107b
107c
107d
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145
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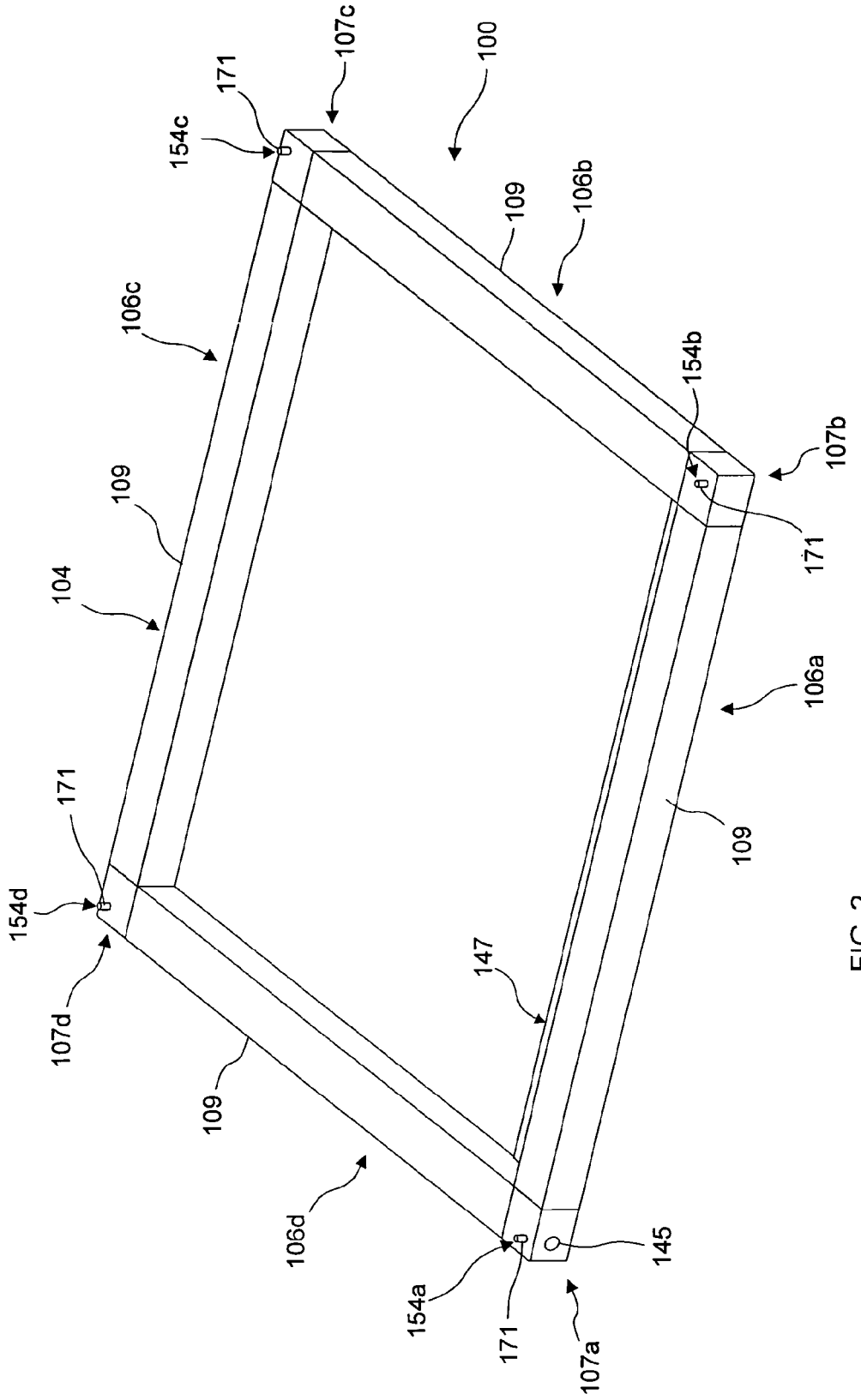
149
153
154a
154b
154d
155a
155b
155c
171
A

FIG. 1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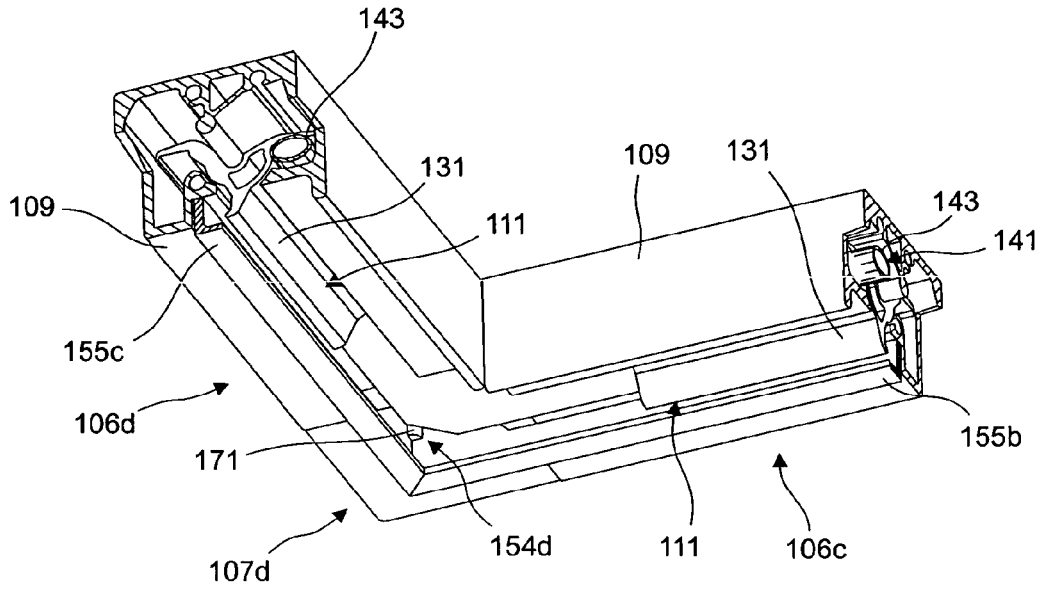
107d
109
106d
145
154a
171
107a

FIG. 2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106c

FIG. 3

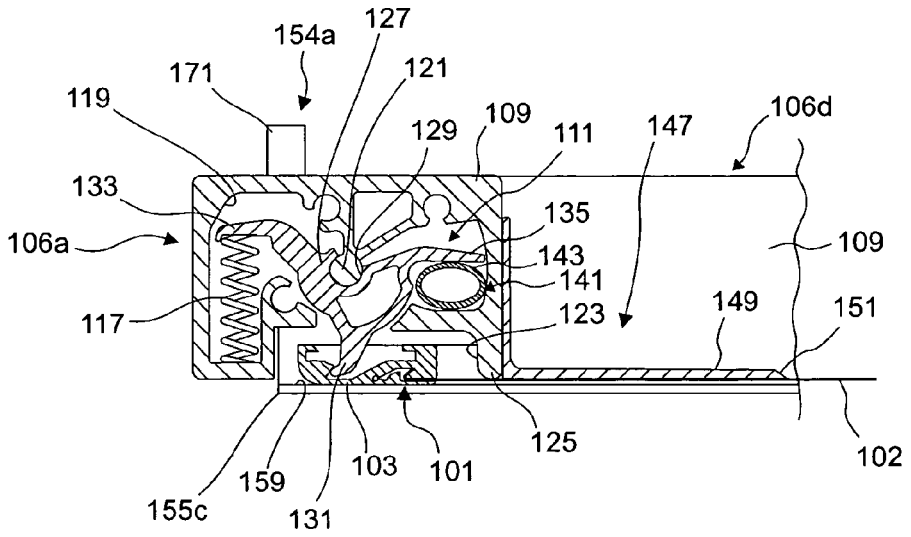

154a
127
171
121
119
129
109
111
147
106d
133
135
106a
143
109
141
117
123
149
151
125
102
159
103
101
155c
131

FIG. 5

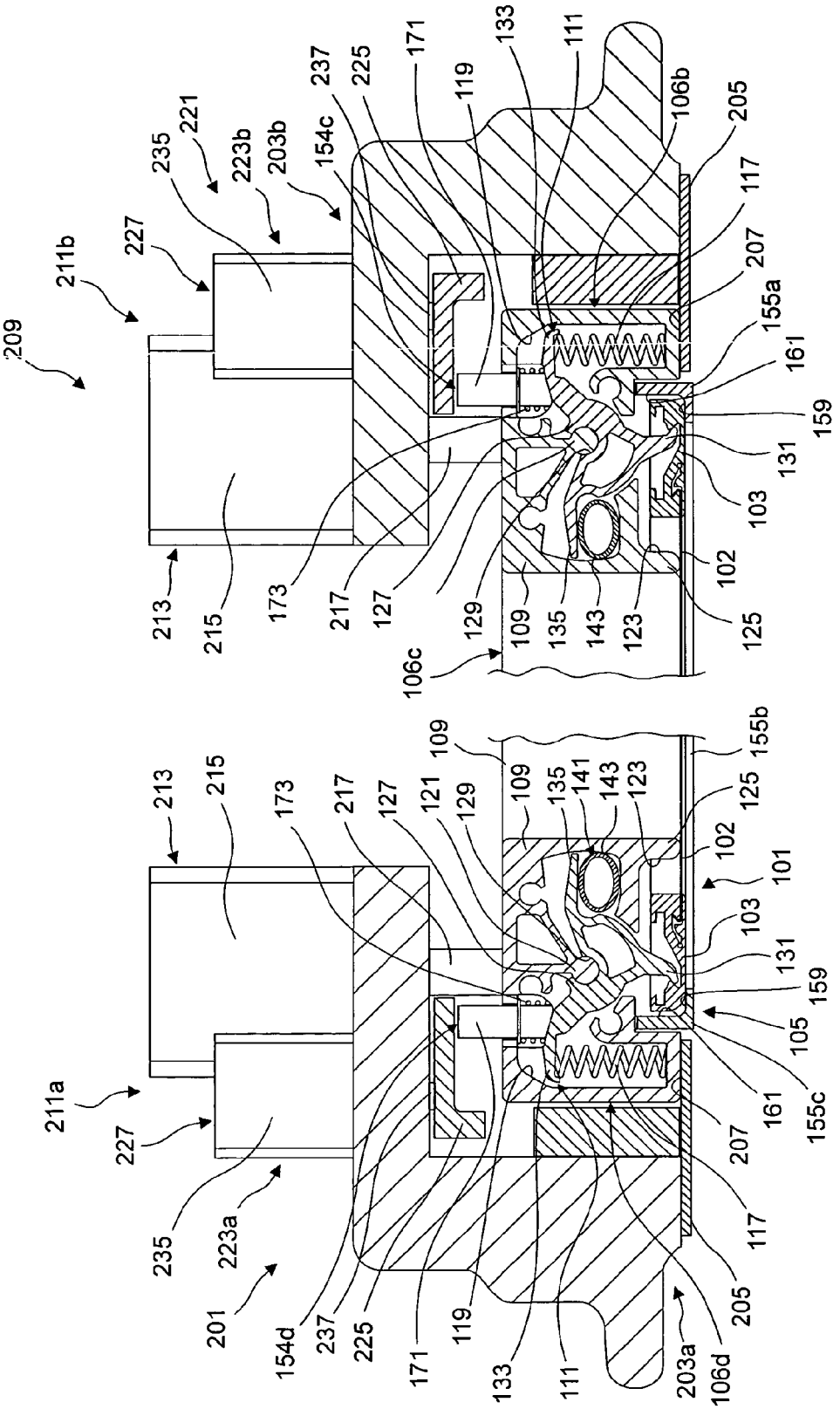

209
211b
227
235
221
223b
203b
154c
237
225
171
119
133
111
106b
205
117
207
155a
161
159
131
103
102
125
109
135
143
123
106c
129
127
217
173
213
215
211a
227
235
223a
201
154d
237
225
171
119
133
111
203a
106d
205
117
207
161
155c
105
159
131
103
101
102
125
155b
109
121
141

FIG. 4

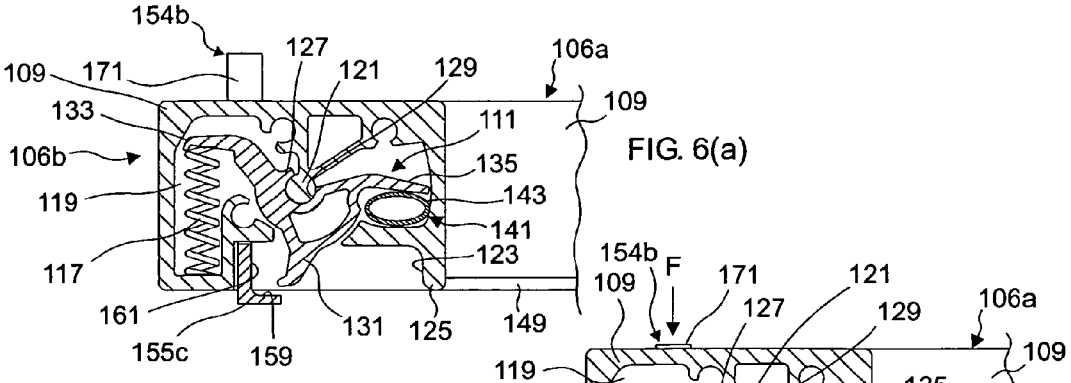


FIG. 6(a)

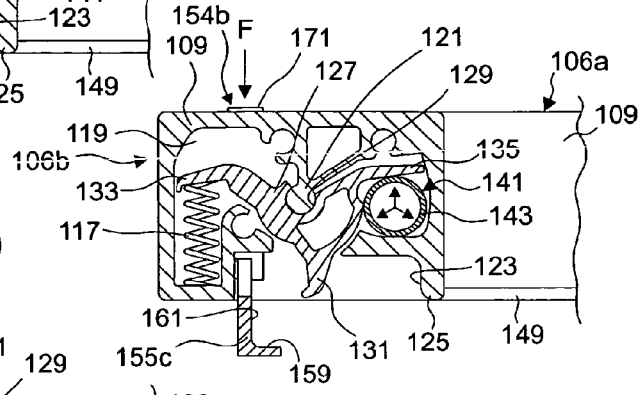


FIG. 6(b)

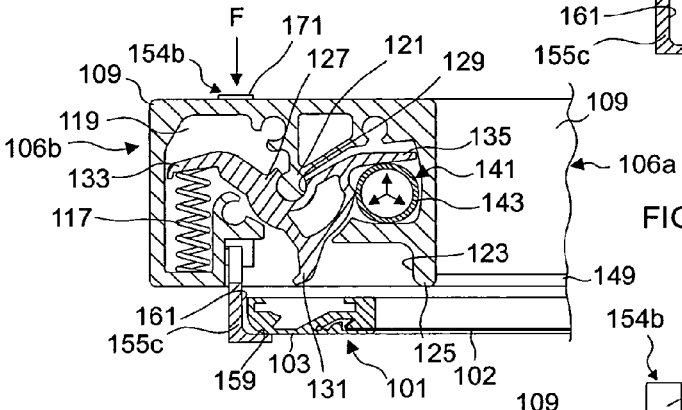


FIG. 6(c)

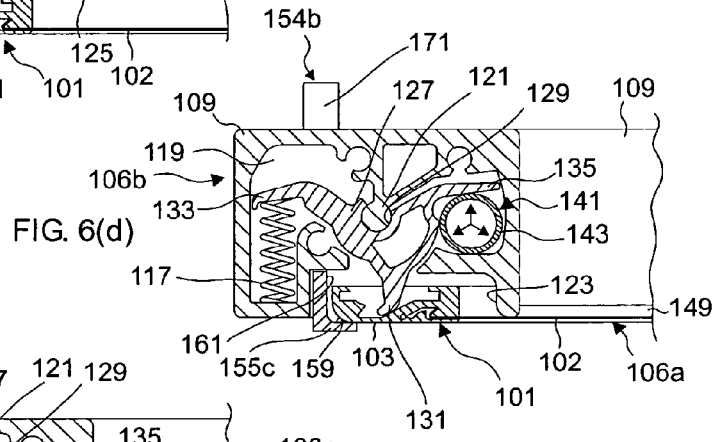


FIG. 6(d)

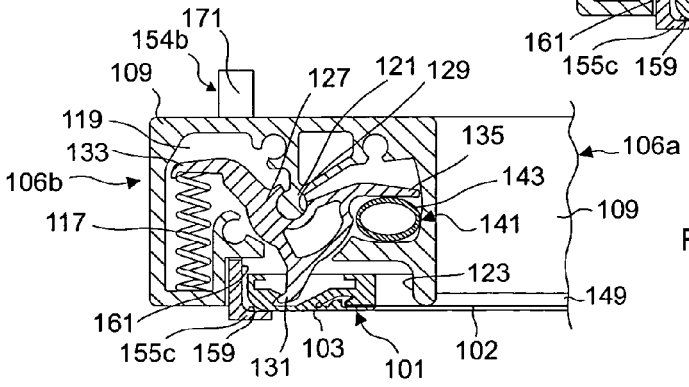
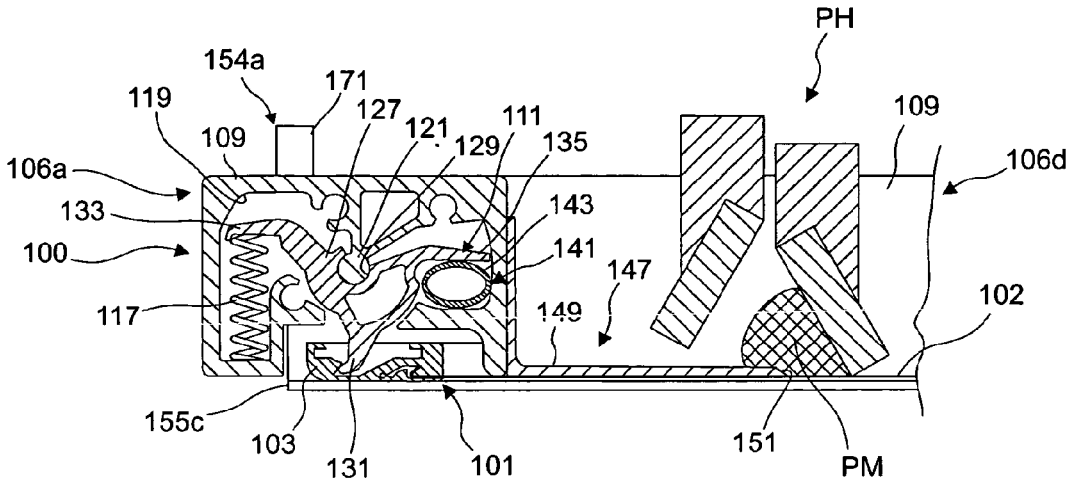


FIG. 6(e)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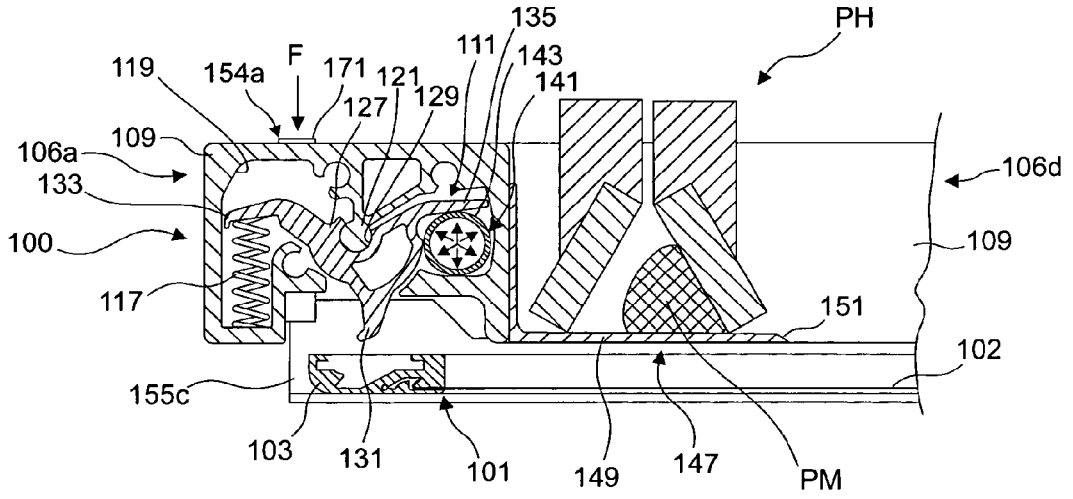
154a
171
119
127
121
111
109
129
135
109
106d
106a
133
143
100
141
147
102
117
149
155c
103
131
101
151
PM

FIG. 7(a)


135
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111
119
154a
F
171
121
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141
127
129
109
106a
106d
133
100
109
117
151
102
155c
103
131
101
149
147
PM

FIG. 7(b)

FRAME ASSEMBLY FOR SUPPORTING PRINTING SCREENS, A FRAME SUPPORT MECHANISM FOR SUPPORTING THE SAME, AND A METHOD OF MOUNTING PRINTING SCREENS IN A SCREEN PRINTING MACHINE

The present invention relates to a frame assembly for supporting de-mountable printing screens, often alternatively referred to as stencils or foils, for use in a screen printing machine, a frame support mechanism for supporting the same, and a method of mounting printing screens in screen printing machines.

A printing screen, typically comprising a screen sheet formed of a metal or plastic, includes apertures which define the pattern to be printed, with the screen being located over an object to be printed and printing medium forced through the apertures to provide the required print.

De-mountable printing screens are finding increasing favour as compared to glued screens. Key benefits include ease of use, cheaper replacement cost, improved handling logistics in not requiring the frame to be returned when requiring a replacement printing screen, and fewer frames are needed as many printing screens can be used in one frame. Various competing systems are in use, including the VECTORGUARD® frame system, as supplied by DEK INTERNATIONAL GMBH (Zürich, Switzerland), and disclosed in WO-A-2003/093012.

The current frame systems for printing liquid print media onto planar substrates require the printing screens to be loaded and tensioned in frames externally of the screen printing machines, using a loading/unloading jig. In requiring the removal of the frame from the screen printing machine, the print head, typically a squeegee mechanism, has be lifted clear of the frame, and also any residual print medium has to be removed from the printing screen. The size and weight of the frame and accompanying foil make this operation awkward, and the need to remove the residual print medium can make the process particularly time consuming.

It is an aim of the present invention to provide an improved frame assembly and frame supporting mechanism, which allows for the in situ replacement of printing screens. Although printing screens are only slightly smaller in size than the supporting frame, printing screens are considerably lighter and easier to handle.

In one aspect the present invention provides a frame assembly for tensioning a printing screen, the frame assembly comprising: a frame unit to which a printing screen is in use tensioned; and a screen loading mechanism for loading a printing screen into and unloading a printing screen from the frame unit, wherein the screen loading mechanism comprises a screen loading member which is movably coupled to the frame unit between a screen-receiving position in which a printing screen can be loaded into or removed from the screen loading member and a loaded position in which the printing screen is loaded into the frame unit, and at least one actuator element which is coupled to the screen loading member and actuatable to move the screen loading member between the screen-receiving and loaded positions.

The present invention also extends to a screen printing machine incorporating the above-described frame assembly.

In another aspect the present invention provides a screen printing machine, comprising: a frame unit to which a printing screen is in use tensioned; and a screen loading mechanism for loading a printing screen into and unloading a printing screen from the frame unit, wherein the screen loading mechanism comprises a screen loading member which is movably coupled to the frame unit between a screen-receiving position in which a printing screen can be loaded into or removed from the screen loading member and a loaded position in which the printing screen is loaded into the frame unit, and at least one actuator element which is coupled to the screen loading member and actuatable to move the screen loading member between the screen-receiving and loaded positions.

In a further aspect the present invention provides a frame support mechanism for supporting a frame assembly which includes a de-mountable printing screen, the frame support mechanism comprising: a frame support member to which a frame assembly is in use mounted, wherein the frame assembly comprises a screen loading member which is movable between a screen-receiving position in which a printing screen can be loaded into or removed from the screen loading member and a loaded position in which the printing screen is loaded in an operative position in the frame assembly, and at least one actuator element which is coupled to the screen loading member and actuatable to move the screen loading member between the screen-receiving and loaded positions; and an actuator mechanism which is operable to actuate the at least one actuator element of the frame assembly to move the screen loading member of the frame assembly between the screen-receiving and loaded positions.

The present invention also extends to a screen printing machine incorporating the above-described frame support mechanism.

In a still further aspect the present invention provides a screen printing machine, comprising: a frame support member to which a frame assembly is in use mounted, wherein the frame assembly comprises a screen loading member which is movable between a screen-receiving position in which a printing screen can be loaded into or removed from the screen loading member and a loaded position in which the printing screen is loaded in an operative position in the frame assembly, and at least one actuator element which is coupled to the screen loading member and actuatable to move the screen loading member between the screen-receiving and loaded positions; and an actuator mechanism which is operable to actuate the at least one actuator element of the frame assembly to move the screen loading member of the frame assembly between the screen-receiving and loaded positions.

In a yet further aspect the present invention provides a frame assembly for tensioning a printing screen, the frame assembly comprising: a frame unit to which a printing screen is in use tensioned, wherein the frame unit includes a support station adjacent an inner edge thereof onto which a print head can be parked prior to separation of the printing screen from the frame unit, such as to provide for removal of the print head and associated print medium from the printing screen prior to separation of the printing screen from the frame unit.

The present invention also extends to a screen printing machine incorporating the above-described frame assembly.

In a still yet further aspect the present invention provides a screen printing machine, comprising: a frame unit to which a printing screen is mounted; and a support station onto which a print head can be parked prior to separation of the printing screen from the frame support member, such as to provide for removal of the print head and associated print medium from the printing screen prior to separation of the printing screen from the frame support member.

In yet another aspect the present invention provides a method of mounting a printing screen in a screen printing machine, comprising the steps of: providing a frame unit to which a printing screen is mounted; providing a screen loading mechanism for loading a printing screen into and unload-

ing a printing screen from the frame unit, wherein the screen loading mechanism comprises a screen loading member which is movably coupled to the frame unit between a screen-receiving position in which a printing screen can be loaded into or removed from the screen loading member and a loaded position in which the printing screen is loaded into the frame unit; moving the screen loading member to the screen-receiving position; loading a printing screen into the screen loading member when positioned in the screen-receiving position; and moving the screen loading member to the loaded position in which the printing screen is loaded into the frame unit.

In yet still another aspect the present invention provides a method of mounting a printing screen in a screen printing machine, comprising the steps of: providing a frame unit to which a printing screen is mounted; providing a support station adjacent an inner edge of the frame unit onto which a print head can be parked prior to separation of the printing screen from the frame unit; and parking a print head on the support station prior to removing the printing screen from the frame unit, thereby enabling removal of the print head and associated print medium from the printing screen prior to separation of the printing screen from the frame unit.

Preferred embodiments of the present invention will now be described hereinbelow by way of example only with reference to the accompanying drawings, in which:

FIG. **1** illustrates a perspective view from below of a frame assembly for tensioning a printing screen in accordance with a preferred embodiment of the present invention;

FIG. **2** illustrates a perspective view from above of the frame assembly of FIG. **1**;

FIG. **3** illustrates in enlarged scale a fragmentary perspective view (region A in FIG. **1**) from below of one corner of the frame assembly of FIG. **1**;

FIG. **4** illustrates a first vertical sectional view (along section I-I in FIG. **1**) through the frame assembly of FIG. **1**, where mounted in a frame supporting mechanism in accordance with a preferred embodiment of the present invention;

FIG. **5** illustrates a second vertical sectional view (along section II-II in FIG. **1**) through one of the frame members of the frame assembly of FIG. **1**;

FIGS. **6**(*a*) to (*e*) illustrate the operation of the frame assembly of FIG. **1** when mounting a printing screen thereto; and

FIGS. **7**(*a*) and (*b*) illustrate steps in the operation of the frame assembly of FIG. **1** when de-mounting a printing screen therefrom.

FIGS. **1** to **5** illustrate a frame assembly **100** for tensioning a printing screen **101** in accordance with a preferred embodiment of the present invention.

In this embodiment, as illustrated in FIG. **4**, the screen **101** comprises a screen sheet **102**, typically formed of a metal or plastic, which includes a pattern of apertures through which a printing medium is printed, and engagement members **103** at each of the edges of the screen sheet **102** by which the screen **101** is tensioned. WO-A-2003/093012 discloses examples of such printing screens.

The frame assembly **100** comprises a frame unit **104** to which the screen **101** is tensioned and a loading mechanism **105** for loading the screen **101** into the frame unit **104**.

The frame unit **104** comprises first, second, third and fourth frame members **106***a-d*, in this embodiment elongate members, for engaging respective edges of the screen **101**, and first, second, third and fourth corner pieces **107***a-d* which connect the respective ends of the frame members **106***a-d*. In this embodiment the frame members **106***a-d* are connected to the corner pieces **107***a-d* by screws, but in an alternative embodiment the frame members **106***a-d* and the corner pieces **107***a-d* could be configured to be a press-fit connection.

The frame members **106***a-d* each comprise a frame element **109**, which frame elements **109** are connected to the respective corner pieces **107***a-d*, in this embodiment by screws, such as to define a rigid frame, a plurality of engagement elements **111** for engaging a respective edge of the screen **101**, in this embodiment through the engagement member **103** at the respective edge of the screen **101**, which engagement elements **111** are pivotally coupled to the frame element **109** such as to be pivotable in one, tensioning sense to tension the screen **101** and the other, opposite sense to allow for fitting and removal of the screen **101**, and a plurality of biasing elements **117** for applying a biasing force to respective ones of the engagement elements **111**, which biasing force acts to bias the engagement elements **111** to pivot in the tensioning sense and apply a tension to the respective edge of the screen **101**. In this embodiment the provision of a plurality of engagement elements **111** for engagement with each edge of the screen **101** facilitates the application of a controlled tension across the length of each edge of the screen **101**. In addition, the provision of a plurality of engagement elements **111** for engagement with each edge of the screen **101** allows for each edge of the screen **101** to be tensioned with a predeterminable tension profile, for example, to a higher tension at the respective ends.

Each of the frame elements **109** includes a central, elongate cavity **119** in which the respective engagement elements **111** are disposed along the length thereof, and a pivot bead **121**, in this embodiment a part-circular bead, which extends along the length of the cavity **119** to which the respective engagement elements **111** are pivotally hinged, as will be described in more detail hereinbelow. In this embodiment the engagement elements **111** of each frame member **106***a-d* are juxtaposed in end-to-end relation. In an alternative embodiment the engagement elements **111** of each frame member **106***a-d* could be disposed in spaced relation.

Each of the frame elements **109** further includes an elongate, screen recess **123** at a lower, mounting surface for receiving the engagement member **103** at the respective edge of the screen **101** and into which the respective engagement elements **111** extend to engage the engagement member **103**, and a guide **125** at an inner edge over which the screen sheet **102** of the screen **101** is tensioned.

In this embodiment the frame elements **109** are fabricated from an extrusion, here an aluminum extrusion, with the extrusion being sectioned at the required lengths.

Each of the engagement elements **111** comprises a body **127** which includes a pivot recess **129**, in this embodiment a part-circular recess, which extends along the length thereof and in which the pivot bead **121** of the respective frame element **109** is held captive, whereby the engagement elements **111** are captively pivotable to the respective frame elements **109**.

Each of the engagement elements **111** further includes a first, engagement arm **131** which extends into the screen recess **123** in the respective frame element **109** for engagement with the engagement member **103** at the respective edge of the screen **101**. In this embodiment the engagement arm **131** extends substantially orthogonally to the lower, mounting surface of the respective frame element **109**. In this embodiment the engagement arm **131** comprises a continuous bar, but in other embodiments can have any desired form, for example, as a comb structure for engaging slots which provide the engagement member **103** at the respective edge of the screen **101**.

Each of the engagement elements **111** further includes a second, biasing arm **133** which is engaged by respective ones of the biasing elements **117**, in this embodiment by a pair of the biasing elements **117**, such as to bias the engagement element **111** to pivot in the tensioning sense, whereby the distal end of the engagement arm **131** is biased in a direction outwardly from the inner edge of the respective frame element **109** to tension the respective edge of the screen **101**. In this embodiment the biasing arm **133** extends substantially parallel to the lower, mounting surface of the respective frame element **109** in a direction towards the outer edge of the respective frame element **109**. In this embodiment the biasing elements **117** are configured to apply a biasing force to the biasing arm **133** in a direction substantially orthogonal to the lower mounting surface of the respective frame element **109**.

Each of the engagement elements **111** further includes a third, operating arm **135** which allows for operation of the engagement elements **111** to enable the fitting of the screen **101**, as will be described in more detail hereinbelow. In this embodiment the operating arm **135** extends substantially parallel to the lower, mounting surface of the respective frame element **109** in a direction towards the inner edge of the respective frame element **109**.

In this embodiment the engagement elements **111** are fabricated from an extrusion, here an aluminum extrusion, with the extrusion being sectioned at the required lengths.

The frame unit **104** further comprises a counter-biasing element **141** which is operable, in this embodiment commonly, to engage the operating arms **135** of each of the engagement elements **111** to apply a counter-biasing force to the operating arms **135**, such as to counter-bias the engagement elements **111** to overcome the normal biasing force of the biasing elements **117** and cause the engagement elements **111** to adopt a position in which the screen **101** is released from engagement with the engagement elements **111**, such as to allow for the fitting or removal of the screen **101**. In this embodiment the counter-biasing element **141** comprises a single elongate inflatable bladder **143**, here a pneumatic bladder, which is threaded through the central cavities **119** of the frame elements **109** adjacent the operating arms **135** of the engagement elements **111** and through the corner pieces **107***a-d*, as illustrated in FIG. **3**, and a fluid connector **145**, here a quick-fit pneumatic connector, which is connected to one end of the bladder **143** such as to allow for inflation and deflation of the bladder **143** by a separate actuator (not illustrated), with the other end of the bladder **143** being closed. In this embodiment the fluid connector **145** is mounted in one of the corner pieces **107***a-d*, here the first corner piece **107***a*. In this embodiment the counter-biasing element **141** is configured to apply a counter-biasing force to the operating arms **135** in a direction substantially orthogonal to the lower, mounting surface of the respective frame elements **109**.

As illustrated in FIG. **5**, the frame unit **104** further comprises a support station **147** which is located adjacent the inner edge of the frame element **109** of one of the frame members **106***a-d*, in this embodiment the first frame member **106***a*, onto which a print head PH, such as a squeegee mechanism, can be parked, such as to support the print medium PM which is being operated upon by the print head PH and thereby allow for the screen **101** to be changed without requiring any special action in relation to the print head PH and in particular the print medium PM, typically the removal of the print medium PM from the surface of the screen **101** as would otherwise be required.

In this embodiment the support station **147** includes a planar, sheet element **149**, which extends inwardly from the lower surface of the frame element **109** and has a sufficient width to receive the print head PH thereon. In this embodiment the sheet element **149** has a tapered leading edge **151**, such as to facilitate the movement of the print head PH thereonto.

The screen loading mechanism **105** comprises a loading member **153** which is movably coupled to the frame unit **104** between a screen-receiving position, as illustrated in FIG. **6**(*c*), in which the loading member **153** is spaced from the frame unit **104** to allow the screen **101** to be loaded into the loading member **153**, and a loaded position, as illustrated in FIG. **6**(*d*), in which the screen **101** is located at the frame unit **104** at a position which allows for tensioning of the screen **101**, and at least one actuator element **154**, in this embodiment a plurality of actuator elements **154***a-d* which are coupled to the loading member **153** such as to move the loading member **153** between the screen-receiving and loaded positions on actuation.

In this embodiment the loading member **153** comprises a plurality of support elements **155** which are movably coupled to the frame elements **109** of respective ones of the frame members **106***a-d*, in this embodiment first, second and third support elements **155***a, b, c* which are movably coupled to the frame elements **109** of the second, third and fourth frame members **106***b, c, d* and together define a U-shaped section when viewed from above, which allows for the screen **101** to be slid thereinto and captively received.

In this embodiment the support elements **155***a-c* comprise elongate elements which extend along the lengths of the respective ones of the frame elements **109**.

The support elements **155***a-c* each define a support surface **159**, on which the screen **101** is supported, and a guide surface **161**, which acts to guide the screen **101** to the required position for loading the screen **101** into the frame unit **104**. In this embodiment the support elements **155***a, b, c* comprise L-shaped bars, the inner faces of which define the support and guide surfaces **159**, **161**. With this configuration, the opposing support elements **155***a, c*, in this embodiment at the frame elements **109** of the second and fourth frame members **106***b, d*, act as lateral guides as the screen **101** is slid onto the loading member **153**, and the other, rear support element **155***b* acts as a rear guide, which defines a stop to the extent of insertion of the screen **101**.

In this embodiment the actuator elements **154***a-d* are coupled to the respective ends of the support elements **155***a-c*, with the third and fourth actuator elements **154***c, d* being commonly coupled to the ends of the first and second support elements **155***a, b* and the second and third support elements **155***b, c*, respectively.

In this embodiment the actuator elements **154***a-d* extend from respective ones of the corner pieces **107***a-d*, here in symmetrical relation, and at the respective sides of the frame assembly **100**. This configuration advantageously provides for actuation of the actuator elements **154***a-d* irrespective of the extent to which the frame assembly **100** is inserted into the screen printing machine, and thereby allows for manual positioning of the frame assembly **100** by the operator to a desired position, and is not constrained to a position as defined by the actuator elements **154***a-d*.

In this embodiment, as illustrated in FIG. **4**, the actuator elements **154***a-d* each comprise an actuator pin **171** which projects from the other, upper surface of the frame unit **104** to which the support member **153** is located, and a biasing element **173**, here a resilient element, such as a compression spring, which is operative normally to bias the actuator pin **171** to an extended, rest position, as illustrated in FIG. **6**(*a*), in which the support member **153** is in the loaded position. With this configuration, the actuator pins **171** can be moved from

the extended, rest position to a depressed, actuated position, as illustrated in FIG. **6**(*b*), in which the actuator pins **171** are depressed and the support member **153** is moved to the screen-receiving position for allowing the screen **101** to be loaded thereinto or removed therefrom.

FIG. **4** illustrates a frame support assembly **201** in accordance with a preferred embodiment of the present invention, in this embodiment of a screen printing machine, where supporting the frame assembly **100**.

The frame support assembly **201** comprises first and second frame support members **203***a, b*, in this embodiment elongate members, which are disposed in opposed relation to receive opposite frame members **106***d, b* of the frame assembly **100**.

In this embodiment the frame support members **203***a, b* each comprise a support element **205**, here in the form of a shelf, which defines a support surface **207** for supporting the frame members **106***d, b* of the frame assembly **100**.

In this embodiment the frame support assembly **201** further comprises a frame clamping mechanism **209** for clamping the frame assembly **100** to the frame support assembly **201**.

In this embodiment the frame clamping mechanism **209** comprises first and second clamp units **211***a, b*, which are associated with respective ones of the first and second frame support members **203***a, b* and operative to clamp the frame assembly **100** to the frame support assembly **201**.

In this embodiment the first and second clamp units **211***a, b* each comprise at least one piston element **213**, here comprising a piston **215** and a piston rod **217**, which is actuated by the piston **215** to clamp the frame assembly **100** to the frame support members **203***a, b* of the frame support assembly **201**.

In an alternative embodiment the frame assembly **100** could be permanently mounted in the screen printing machine, but such permanent mounting does not allow for any "rough" manual positioning of the frame assembly **100** relative to the printing zone.

In another alternative embodiment the frame elements **109** of the frame assembly **100** could be formed as an integral part of the screen printing machine, and in one embodiment define part of the chassis or supporting frame of the screen printing machine. This configuration advantageously reduces the complexity and weight of the screen printing machine, in avoiding the need for a separate frame support assembly **201**, which is necessarily of bulky construction to support the relatively-large frame assembly **100**.

The frame support assembly **201** further comprises an actuator mechanism **221** for actuating the actuator elements **154***a-d* of the loading mechanism **105** of the frame assembly **100**.

In this embodiment the actuator mechanism **221** comprises first and second actuator units **223***a, b*, which are associated with respective ones of the first and second frame support members **203***a, b* and operative to actuate the actuator elements **154***a-d* of the loading mechanism **105** of the frame assembly **100**.

In this embodiment the actuator units **223***a, b* each comprise an actuator element **225**, in this embodiment an elongate plate which extends over a length corresponding to the length of the frame members **106***d, b*, and at least one piston element **227**, in this embodiment a plurality of piston elements **227**, here each comprising a piston **235** and a piston rod **237**, which is actuated by the piston **235** to drive the actuator element **225** to actuate the actuator elements **154***a-d* of the loading mechanism **105** of the frame assembly **100**.

Operation of the frame assembly **100** and the frame support assembly **201** will now be described hereinbelow.

The fitting of a printing screen **101** to the frame assembly **100** will now be described hereinbelow with reference to FIGS. **6**(*a*) to (*e*).

FIG. **6**(*a*) illustrates the normal, rest configuration of the frame assembly **100**.

In a first operation, the counter-biasing element **141** is actuated, in this embodiment by inflating the bladder **143**, to apply a counter-biasing force to the operating arms **135** of the engagement elements **111**, such as to counter-bias the engagement elements **111** to overcome the normal biasing force of the biasing elements **117** and cause the engagement elements **111** to adopt a screen-receiving position for receiving the screen **101**, and the actuator elements **154***a-d* are actuated, here by depression of the actuator pins **171** thereof by the actuator units **223***a, b* of the frame support assembly **201**, such as to move the screen support member **153** to the screen-receiving position, in this embodiment in a spaced, lowered position relative to the frame members **106***a-d* of the frame unit **104**, as illustrated in FIG. **6**(*b*).

As illustrated in FIG. **6**(*c*), the screen **101** is then located in position on the screen support member **153**, in this embodiment by sliding the screen **101** into the support member **153** to a loaded position.

Following loading of the screen **101** into the screen support member **153**, the actuator elements **154***a-d* are returned to the first, rest position, in this embodiment by actuating the actuator units **223***a, b* of the frame support assembly **201** to release the biasing force from the actuator pins **171** thereof, whereby the screen support member **153** is moved to the loaded position, as illustrated in FIG. **6**(*d*), in which the engagement members **103** at the edges of the screen **101** are located in the screen recesses **123** in the frame elements **109** of the respective frame members **106***a-d*.

Following mounting of the screen **101** to the frame unit **104**, the counter-biasing element **141** is de-actuated, in this embodiment by deflating the bladder **143**, which de-actuation causes the engagement elements **111** to be pivoted by the biasing force of the biasing elements **117** in the tensioning sense, such as to tension the respective edges of the screen **101**, as illustrated in FIG. **6**(*e*).

The removal of a printing screen **101** from the frame unit **104** is achieved by performing the reverse sequence of operations, but with the additional step of parking a print head PH, in this embodiment a squeegee mechanism comprising a pair of opposed blades, on the support station **147** prior to separation of the screen **101** from the frame unit **104**, as illustrated in FIGS. **7**(*a*) and (*b*), such as to support the print medium PM which is being operated upon by the print head PH and thereby allow for the screen **101** to be changed without requiring any special action in relation to the print head PH and in particular the print medium PM, typically the removal of the print medium PM from the surface of the screen **101** as would otherwise be required.

Finally, it will be understood that the present invention has been described in its preferred embodiments and can be modified in many different ways without departing from the scope of the invention as defined by the appended claims.

In one alternative embodiment the frame members **106***a-d* could each include a single, elongate engagement element **111**.

In other alternative embodiments the biasing elements **117** could be provided by any kind of resilient element, whether tensioned or compressed.

In yet another alternative embodiment the biasing elements **117** could be provided by actuatable elements, for example, an inflatable bladder of the kind as embodied in relation to the counter-biasing element **141**.

Also, in the described embodiments the inflatable bladder **143** of the counter-biasing element **141** is pneumatically operated, but in other embodiments could be hydraulically operated.

The invention claimed is:

1. A frame assembly for supporting a printing screen, the frame assembly comprising:

a frame unit to which a printing screen is in use supported; and

a screen loading mechanism for loading the printing screen into and unloading the printing screen from the frame unit, wherein the screen loading mechanism comprises a screen loading member which is adapted to receive and support the printing screen in a screen-receiving position which is spaced from the frame unit and in which the printing screen can be loaded into or removed from the screen loading member, and the screen loading member is movably coupled to the frame unit between the screen-receiving position and a loaded position which is spaced from the screen-receiving position and in which the printing screen is moved towards the frame unit and loaded into the frame unit, and at least one actuator element which is coupled to the screen loading member and actuatable to move the screen loading member between the screen-receiving and loaded positions.

2. The frame assembly of claim **1**, wherein the screen loading mechanism comprises a plurality of actuator elements.

3. The frame assembly of claim **2**, wherein the actuator elements are arranged to allow for loading of the frame assembly into a screen printing machine in more than one position.

4. The frame assembly of claim **1**, wherein the frame unit comprises a plurality of frame members, and the screen loading member comprises a plurality of support elements which engage edges of the printing screen and are movably coupled to respective ones of the frame members.

5. The frame assembly of claim **4**, wherein the screen loading member comprises at least two support elements which are disposed in opposed relation slidingly to receive the printing screen.

6. The frame assembly of claim **4**, wherein the frame members comprise elongate members and the support elements comprise elongate elements which extend along a length of the respective frame members.

7. The frame assembly of claim **6**, wherein the screen loading mechanism comprises a plurality of actuator elements-which are coupled to respective ends of the support elements.

8. The frame assembly of claim **1**, wherein the at least one actuator element comprises a movable body which is coupled to the support element and extends from the frame unit to be actuatable by an external actuator to be moved between a first position in which the screen loading member is in the loaded position and a second position in which the screen loading member is in the screen-receiving position.

9. The frame assembly of claim **8**, wherein the at least one actuator element further comprises a biasing element which normally biases the movable body to the first position, with the movable body being moved to the second position against the bias of the biasing element.

10. The frame assembly of claim **8**, wherein the first position is an extended position, in which the movable body extends from the frame unit and the second position is a depressed position, in which the movable body is depressed into the frame unit.

11. The frame assembly of claim **1**, wherein the frame unit includes a support station adjacent an inner edge thereof onto which a print head can be parked prior to separation of the printing screen from the frame unit to enable removal of the print head and associated print medium from the printing screen prior to separation of the printing screen from the frame unit.

12. A screen printing machine incorporating the frame assembly of claim **1**.

13. The screen printing machine of claim **12**, wherein the frame unit is provided at least in part by a chassis or supporting frame of the screen printing machine.

14. The screen printing machine of claim **13**, wherein the frame unit is provided by a chassis or supporting frame of the screen printing machine.

15. The screen printing machine of claim **13**, wherein the frame unit is an integral part of the screen printing machine.

16. A frame assembly for supporting a printing screen, the frame assembly comprising:

a frame unit to which a printing screen is in use supported; and

a screen loading mechanism for loading the printing screen into and unloading the printing screen from the frame unit, wherein the screen loading mechanism comprises a screen loading member which receives and supports the printing screen and the screen loading member is movably coupled to the frame unit between a screen-receiving position which is spaced from the frame unit and in which the printing screen can be loaded into or removed from the screen loading member and a loaded position in which the printing screen is moved towards the frame unit and loaded into the frame unit, and at least one actuator element which is coupled to the screen loading member and actuatable to move the screen loading member between the screen-receiving and loaded positions;

wherein the frame unit comprises a plurality of frame members, and the screen loading member comprises a plurality of support elements which are movably coupled to respective ones of the frame members, wherein the screen loading member comprises three support elements which together define a U-shaped profile when viewed from above, with first and second of the support elements being disposed in opposed relation slidingly to receive the printing screen from the one, proximal ends thereof and the other, third support element extending between the other, rear ends thereof.

17. A frame assembly for supporting a printing screen, the frame assembly comprising:

a frame unit to which a printing screen is in use supported, wherein the frame unit includes a support station adjacent an inner edge thereof onto which a print head can be parked prior to separation of the printing screen from the frame unit to enable removal of the print head and associated print medium from the printing screen prior to separation of the printing screen from the frame unit, wherein the support station comprises a platform which extends inwardly from a lower surface of the respective edge of the frame unit to allow for sliding movement of the print head thereonto; and

a screen loading mechanism for loading the printing screen into and unloading the printing screen from the frame unit, wherein the screen loading mechanism comprises a screen loading member which receives the printing screen and is movably coupled to the frame unit between a screen-receiving position in which the printing screen can be loaded into or removed from the screen loading

member and a loaded position in which the printing screen is loaded into the frame unit, and at least one actuator element which is coupled to the screen loading member and actuatable to move the screen loading member between the screen-receiving and loaded positions.

18. The frame assembly of claim **17**, wherein the platform comprises a sheet element.

19. A frame support mechanism for supporting a frame assembly which includes a de-mountable printing screen, the frame support mechanism comprising:

a frame support member to which a frame assembly is in use supported, wherein the frame assembly comprises a frame unit and a screen loading member which is adapted to receive and support the printing screen in a screen-receiving position which is spaced from the frame unit and in which the printing screen can be loaded into or removed from the screen loading member, and the screen loading member is movable between the screen-receiving position and a loaded position which is spaced from the screen-receiving position and in which the printing screen is moved towards the frame unit and loaded in an operative position into the frame unit, and at least one actuator element which is coupled to the screen loading member and actuatable to move the screen loading member between the screen-receiving and loaded positions; and

an actuator mechanism which is operable to actuate the at least one actuator element of the frame assembly to move the screen loading member of the frame assembly between the screen-receiving and loaded positions.

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